International Journal of Advanced Research and Development
ISSN: 2455-4030, Impact Factor: RJIF 5.24
www.newresearchjournal.com/advanced
Volume 1; Issue 5; May 2016; Page No. 08-11

Antibacterial activity of ginger (*Zingiber officinale*) and garlic (*allium Sativum* L.) extracts on Escherichia coli

[1] Vidya B Patil, [2] Pwar NB

[1] Department of Microbiology, L.V.H. College Nashik, Maharashtra India.
[2] Department of biotech Biology, L.V.H. College Nashik, Maharashtra India.

Abstract
Most agents used by humans in the treatment of diseases are of plant origin. *Escherichia coli* are the most commonly present bacterium in the human intestine, which helps in preventing the entry of pathogenic microorganisms. *E. coli* are non-pathogenic in normal conditions, but if present in excess, will become causative agent of various diseases like urinary tract infection, diarrhoea, vomiting etc. With increasing resistance of microorganisms to antibiotics, there is a shift of choice from allopathic to ayurvedic and naturopathy, where herbs and spices are very common ingredients of medicines. Herbs and spices are used in Indian recipes as they impart aroma and flavour to it. Most of the studies performed to check sensitivity of microorganisms for various herbs and spices involve extraction of the active component(s) with some organic solvents. However, when these plant products are used as ingredients of food, the effectiveness of extracts using organic solvents should not be a criterion. In the present study, frequently used herbs and spices are selected, their extracts are made using distilled water and tested for its antimicrobial effect against *E. coli* the most common intestinal non-pathogenic organism. The antibacterial effect of various herbs and spices were evaluated using various methods. All the herbs and spices tested were able to inhibit *E. coli* growth, but Thyme (herb) and Turmeric (spice) were found to be most effective against *E. coli*.
Ginger (*Zingiber officinale*), and Garlic (*allium Sativum L.*) Were chosen to examine their effects on the bacteria Escherichia Coli. To obtain an extract from the spices, an aqueous extraction method combined with filtration was used. The extracted compounds were applied to the bacteria through the paper disk diffusion method.

Keywords: *Escherichia coli*; antibacterial activity, zone of inhibition

1. Introduction
Food borne diseases have always been a major concern in both developing and developed countries. *Campylobacter jejuni*, *Staphylococcus aureus*, *Salmonella* (over 1600 types), *Escherichia coli* O157:H7, *streptococci*, etc. are some of the major bacterial species that causes food borne diseases. *E. coli* are the most commonly found bacterium in the human intestinal tract. Under normal conditions, its presence is conducive to digestive processes. But when present in excess or in virulent form it causes diseases. Virulent strains of *E. coli* can cause gastroenteritis, urinary tract infections, neonatal meningitis etc. With increasing use of drugs, microorganisms are attaining resistance to commonly used antibiotics, which leads to downfall of effectiveness of conventional medicines and therefore, search for new antimicrobial agents has become necessary. Traditional medicines have been used for many centuries by a substantial proportion of the population of India. The interest in the study of medicinal plants as a source of pharmacologically active compounds has increased worldwide. It is recognized that in developing countries like India, plants are the main medicinal source to treat infectious diseases. Approximately 20% of the plants found in the world have been subjected to pharmacological or biological test, and a substantial number of new antibiotics introduced in the market are obtained from natural or semi-synthetic resources. The active ingredients of plants against microorganisms are mostly some of the secondary metabolites (i.e. alkaloids, glycosides etc.) that are present in abundance in herbs and spices commonly used in Indian food preparations. Herbs are small plants used by human being for various purposes like medicines, food supplements for imparting flavour or scant, and as a part of offerings to God since beginning of civilization. Spices have been defined as plant substances from indigenous or exotic origin, aromatic or with strong taste, used to enhance the taste of foods. Spices include leaves (bay, mint, rosemary, coriander, laurel, oregano), flowers (clove), bulbs (garlic, onion), fruits (cumin, red chilli, black pepper), stems (coriander, cinnamon), rhizomes (ginger) and other plant parts.
Allium sativum, known to most as garlic, or the “stinking rose,” is widely recognized for having an array of medical benefits, with antiviral, anti-fungal, and antibacterial properties. Garlic is made of portions known as cloves, which may be separated for cooking and eating. Within these cloves, there are quite a few sulfur-containing chemicals, such as Allicin, and ajoene 3. Allicin produces the odor that is characteristic of the garlic bulb. It is produced when the plant tissue is broken, allowing enzymes like alliinase to react with Allicin to form Allicin. Allicin then acts to protect the plant from further damage 3. However, the enzymes responsible for converting Allicin to Allicin usually denature in humans due to the low pH of the stomach4. Allicin itself also usually begins to break down at temperatures over 40°C 5. Along with its protective abilities, Allicin is believed to be the chemical responsible for garlic's antimicrobial effects
Not only do essential oils protect the garlic plant, but they also demonstrate antioxidant and anticancer effects in humans 6. Studies have found garlic to be effective in blocking the formation of nitrosamines. Nitrosamines are carcinogenic compounds that are either taken in by the body or formed from nitrite and other compounds. Many sulfur-containing compounds from garlic convert the nitrite needed for

nitrosamines into nitrosothiols, thus limiting the production of these carcinogenic compounds 8.Various studies have shown that garlic is also effective against many gram-negative and gram-positive bacteria, such as *Escherichia coli*, *Salmonella*, *Staphylococcus*, and *Streptococcus* species. Many of these bacteria do not develop resistance to Allicin, despite being resistant to antibiotics. One study demonstrated the potential for garlic to act as a meat preservative. Garlic extract was shown to kill about 75% of the *E. coli*

2. Materials and methods

Collection of Plant material

The garlic bulbs and ginger rhizomes were purchased at the Konark Nagar market.

Chemicals

The chemicals used for the work are acetone and methanol, peptone, agar, sodium chloride and meat extract

The Microorganisms

Two microbial strins were selected for experiment on the basis of their pathogenic activity in human beings that is Escherichia coli.

Preparation of bacterial culture-The stock culture of the bacteria used was subcultured at 37°C for 24hrs. Preparation of Extract of each species was prepared by 40gm of the dry material in 400ml acetone and methanol for 48hrs 37°C for extract preparation

Assay for antimicrobial activity

Antimicrobials are agents that kill microorganisms or inhibit their growth. The antimicrobial effects of the plant extracts are sufficient in a way to cater the healing effect.

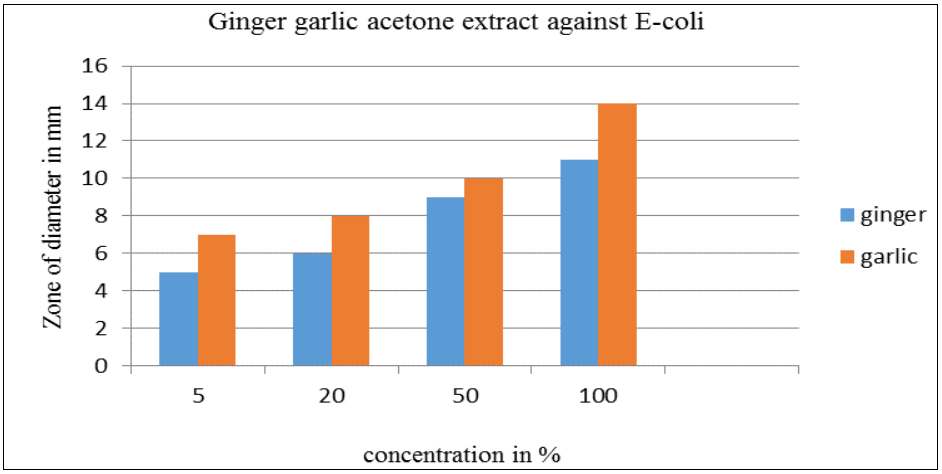
Paper Disc Method

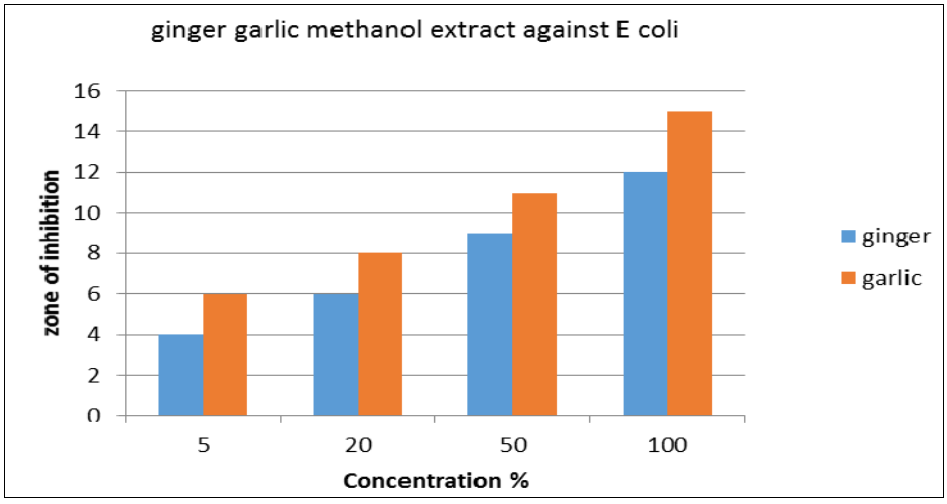
The inoculum was spreaded uniformly in N-agar plates with the help of glass spreader and kept for five minutes. Pre-sterilized paper discs were dipped into different samples (Ginger and Garlic extracts) placed in inoculated plates. The plates were incubated for 24hrs at 37°C and size of clear zones developed surrounding each disc was measured by scale to the nearest mm and were plotted in the graph

Table 1 (A): Zone of inhibition of spice extracts against *E. coli* in well diffusion assay

Plant extract	Dilution of plant extract %								
	Acetone extract				Methanol extract				
Conc / extract	5	20	50	100	5	20	50	100	control
	Zone of inhibition (mm)								
Ginger	5	6	9	11	4	6	9	12	-
garlic	7	8	10	14	6	8	11	15	-

Graf of conc. against zone of inhibition





Minimum Inhibitory Concentration (MIC)
Well diffusion method
Determination of MICs of the spice extracts was done by well diffusion and agar dilution techniques and the concentrations of the extracts used were 5, 20, 50, 100!l/ml. The lowest concentration that did not permit any visible growth when compared with the control was considered as the minimum inhibitory concentration.

3. Results and discussion
Results and discussion from the antibacterial screening tests of the crude extract s of *A. indica* carried out on the selected bacterial isolates *E. coli*,
In present studies antimicrobial activity of two spices garlic and ginger were done. Table -1, graph -1shown the antimicrobial activity of material extracted in acetone shows maximum zone of inhibition is 12 mm and 14mm Similarly the antimicrobial activity of material extracted in methanol showed maximum zone of inhibition 12mm and 15mm

4. Conclusion and recommendation
The present work has shown that *E. coli* were susceptible to crude extracts of *garlic and ginger in vitro* which means the plant has antibacterial property. It is hereby recommended that further research be done towards isolating, purifying and standardizing the active antibacterial ingredients in *both plant material*. Also more work should be carried out to determine the pharmacokinetics, pharmacodynamics and possible toxicity of the pharm coactive ingredient(s).

5. Acknowledgement
I am grateful to my parents for their tremendous support and inspiration.

6. References
1. Abhishek S. Antimicrobial and phytochemical analysis of common Indian spices against foodborne pathogens. Adv BioTech 2011; (5):22-27.
2. Agaoglu S, Dostbil N, Alemdar S. Antimicrobial activity of some spices used in the meat industry. Bulletin of the Veterinary Institute in Pulawy, 2007, 53-57.
3. Gislene GFN, Juliana L, Paulo CF, Giuliana LS. Antibacterial Activity of Plant Extracts and Phytochemicals on Antibiotic Resistant Bacteria. Brazilian J. Microbiology, 2000, 247-256.
4. Hirasa K, Takemasa M. Spice Science and Technology. Marcel Dekker Inc, 1998.
5. Indu MN, Hatha AAM, Abirosh C. Antimicrobial Activity of Some of the South-Indian Spices Against Serotypes of Brazilian Journal of Microbiology, 2006, 153-158.
6. Nanasombat S, Prasertsin V, Graisin K, Shain H, Thanaboripat B, Ahmad I, *et al*. Screening of some Indian medicinal plants for their antimicrobial properties. J. Ethnopharmacol. 1998; 62:183-193.
7. Chattopadhyay RR, Chattopadhyay RN, Maitra SK. Possible mechanism of anti-inflammatory activity of *Azadirachta indica* leaf extract. Indian J. Pharmacol. 1993; 25(2):99-100.
8. Chattopadhyay RR. Possible mechanism of anti-inflammatory activity of *Azadirachta indica* leaf extract: Part IV. Gen. Pharmacol 1996; 27(3):431-434.
9. Chattopadhyay RR, Bandyopadhyay M. Effect of *Azadirachta indica* leaf extract on serum lipid profile changes in normal and streptozotocin induced diabetic rats. Afr. J. Biomed. Res. 2005; 8:101-104.
10. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing; Twentieth Informational Supplement. CLSI document M100-S20, PA 2010; 30(1):38-43.
11. Cunha BA. Antibiotic side effects. Med. Clinics North Am 2001; 85:149-185.
12. Biswas KI, Chattopadhyay RR, Bandopadhyay U, Banerjee RK. Biological activities and medicinal properties of neem (*Azadirachta indica*). Curr. Sci. J. 2002; 82:1336-1345.
13. Ergene A, Guler P, Tan S, Mirici S, Hamzaoglu E, Duran A. Antibacterial and Antifungal Activity of *Heracleum spondylium* subsp. Artvinense. Afr. J. Biotech. 2006 5(11):1087-1089.
14. Ketkar AY, Ketkar CM. In: Schmutterer H (ed.), The Neem tree: Source of unique natural products for integrated pest management, Medicine and other purpose, 1995, 518-525.
15. Lakshmanan KK, Subramanian MS. *Azadirachta indica* AS Juss. stem-bark as anti-leprosy source. Neem and Environment. Oxford and IBH Publisher New Delhi, 1996; 2:31143-31150.
16. Odugbemi T. Medicinal Plants as Antimicrobials In: Outline and pictures of medicinal plants from Nigeria. University of Lagos Press, 2006, 53-64.
17. Todar K. Pathogenic *Escherichia coli*. Online Text of Bacteriology. University of Wisconsin-Madison Department of Bacteriology, 2008. http://www.textbookofbacteriology.net/e.coli.html. Accessed on 10th November 2009.
18. Vermani K, Garg S. Herbal Medicines for Sexually Transmitted Diseases and AIDS. J. Ethnopharmacol. 2002; 80:49-66.
19. World Health Organization (WHO). Summary of WHO guidelines for the assessment of herbal medines. Herbal Gram 1993; 28:13-14.
20. Yagoup SO, Shami EA, Ahmed B, Asha ZE. Antimicrobial activity of some medicinal plants against some Gram positive, Gram negative and fungi. Department of Molecular Biology, EL Neelain University, Sudan, 2007. www.astf.net Accessed on 20th August 2009.
21. Yoa J, Moellering R. Antibacterial agents. Manual of Clinical Microbiology. ASM, Washington, DC, 1995, 1281-1290.
22. Mead PS, Slutsker L, Dietz V, *et al*. Food related illness and dead in the United States. *Emerging Infectious Diseases*, 1999, 607-625.
23. Consumer information from USDA. *Food Safety and Inspection Service*, Food Safety and Consumer Education Office, 1997.
24. Pei SJ. Ethnobotanical approaches of traditional medicine studies: Some experiences from Asia. *Pharmaceutical Biology* 2001; 39:74-79.
25. Mothana RA, Lindequist U. Antimicrobial activity of some medicinal plants of the island Soqotra. *Journal of Ethno pharmacology*. 2005; 96(1-2):177-181.

26. Tenover FC, Weige LM, Appelbaum PC, *et al*. Vancomycin-Resistant *Staphylo coccus aureus* Isolate from a patient in Pennsylvania. *Antimicrob. Agents Chemother* 2004; 48(1):275-280.
27. Germano PML, Germano MIS. Importânciae riscos das especiarias. *Higiene Alimentar*, 1998; 239-312.
28. Shelef LA. Antimicrobial effects of spices. *Journal of Food Safety*. 1983; 6:29-44.
29. Darmadji P, Izumimoto M, Ketaoka K. Antibacterial effect of spices on fermented meat. *Agrosains* 1993; 83:1-6.
30. Farag RS, Daw ZY, Hewed FM, *et al*. Antimicrobial activity of some Egyptian spice oils. *Journal of Food Protection*. 1989; 52:665-667.
31. Sagdiç O, Karahan AG, Ozcan M, *et al*. Effect of some spice extracts on bacterial inhibition, *Food Science and Technology International* 2003; 9(5):353-358.
32. Shami MA, Fadl FA, Sirry AR, *et al*. Antifungal property of garlic, clove juice compared with fungicidal treatment against *Fusarium* with watermelon. *Egyptian Journal of Phytopathology*. 1985; 17:55-62.
33. Akgül A, Kivanç M. Inhibitory effects of six Turkish thyme-like spices on some common food-borne bacteria. *Nahrung* 1988; 32(2):201-203.
34. Cosentino S, Tuberoso CIG, Pisano B, *et al*. *In-vitro* antimicrobial activity and chemical composition of *Sardinian thymus* essential oils, *Letters in Applied Microbiology* 1999; 29:130-135.